2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct 2020)

Recife, Brazil
9 – 13 November 2020

IEEE Catalog Number: CFP20D63-POD
ISBN: 978-1-7281-7676-5

Copyright © 2020 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number: CFP20D63-POD
ISBN (Print-On-Demand): 978-1-7281-7676-5
ISBN (Online): 978-1-7281-7675-8

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)

ISMAR-Adjunct 2020

Table of Contents

Message from the ISMAR 2020 General Chairs xviii
Message from the ISMAR 2020 Science and Technology Program Chairs and TVCG Guest Editors xix
Message from the ISMAR 2020 Science and Technology Program Chairs xxi
Message from the ISMAR 2020 Science and Technology Poster Chairs xxiii
Message from the Workshop and Tutorial Chairs xxv
Message from the ISMAR 2020 Demos Chairs xxvi
ISMAR 2020 Conference Committee Members xxvii
ISMAR 2020 Science and Technology Program Committee Members xxix
ISMAR 2020 Steering Committee Members xxxi
ISMAR 2020 Reviewers xxxiii
Keynotes xxxvii
Sponsors and Supporters xl

Poster Presentations

A Conceptual Model for Data Collection and Analysis for AR-Based Remote Collaboration Evaluation 1
Bernardo Marques (DETI-IEETA, Universidade de Aveiro, Portugal), António J. Teixeira (University of Aveiro, Portugal), Samuel Silva (Universidade de Aveiro, Portugal), João Alves (DETI-IEETA, Universidade de Aveiro, Portugal), Paulo Dias (University of Aveiro, Portugal; IEETA - Institute of Electronics and Informatics Engineering of Aveiro, University of Aveiro, Portugal), and Beatriz Sousa Santos (University of Aveiro, Portugal; IEETA- Institute of Electronics and Informatics Engineering of Aveiro, University of Aveiro, Portugal)

An Evaluation of AR-Assisted Navigation for Search and Rescue in Underground Spaces 3
Doga Cagdas Demirkan (Colorado School of Mines, Golden, Colorado, USA) and Sebnem Duzgun (Colorado School of Mines, Golden, Colorado, USA)

An Image-Based Method for Measuring Strabismus in Virtual Reality ..5
Wolfgang Andreas Mehringer (Machine Learning and Data Analytics Lab, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany), Markus Gerhard Wirth (Machine Learning and Data Analytics Lab, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany), Stefan Gradl (Machine Learning and Data Analytics Lab, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany), Luis Simon Durner (FAU Erlangen-Nürnberg, Germany), Matthias Ring (Machine Learning and Data Analytics Lab, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany), Annemarie F. Laudanski (University of Waterloo, Canada), Bjoern M Eskofier (Machine Learning and Data Analytics Lab, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany), and Georg Michelson (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany; Talkingeyes & More GmbH, Germany)

AR Circuit Constructor: Combining Electricity Building Blocks and Augmented Reality for Analogy-Driven Learning and Experimentation ..13
Tobias Kreienbühl (Lucerne University of Applied Sciences and Arts, Switzerland), Richard Wetzel (Lucerne University of Applied Sciences and Arts, Switzerland), Naomi Burgess (Lucerne University of Applied Sciences and Arts, Switzerland), Andrea Maria Schmid (University of Teacher Education Lucerne, Switzerland), and Dorothee Brovelli (University of Teacher Education Lucerne, Switzerland)

AR Mini-Games for Supermarkets ..19
Urs Riedlinger (Fraunhofer FIT, Sankt Augustin, Germany), Leif Oppermann (Fraunhofer FIT, Sankt Augustin, Germany), Yücel Uzun (Fraunhofer FIT, Sankt Augustin, Germany), and Constantin Brosda (Fraunhofer FIT, Sankt Augustin, Germany)

Augmented Reality for Pack Optimization using Video and Depth Data ..21
Mario Lorenz (Chemnitz University of Technology, Germany; University Hospital Leipzig, Germany), Felix Pfeiffer (Chemnitz University of Technology, Germany), and Philipp Klimant (Chemnitz University of Technology, Germany)

Catching the Drone – A Tangible Augmented Reality Game in Superhuman Sports ..24
Christian Eichhorn (Research Group Augmented Reality, Technical University of Munich, Germany), Adnane Jadid (Fachgebiet Augmented Reality, Technical University of Munich, Germany), David A. Plecher (Research Group Augmented Reality, Technical University of Munich, Germany), Sandro Weber (Research Group Augmented Reality, TUM, Munich, Germany), Gudrun Klinker (Department of Informatics, Technical University of Munich, Germany), and Yuta Itoh (Tokyo Institute of Technology, Japan)

Comparing Methods for Mapping Facial Expressions to Enhance Immersive Collaboration with Signs of Emotion ..30
Natalie Hube (Mercedes-Benz AG, Sindelfingen, Germany; VISUS, University of Stuttgart, Germany), Oliver Lenz (Technische Universität Dresden, Germany), Lars Engeln (Technische Universität Dresden, Germany), Rainer Groh (Technische Universität Dresden, Germany), and Michael Sedlmair (VISUS, University of Stuttgart, Germany)

Concept for a Virtual Reality Robot Ground Simulator ..36
Mario Lorenz (Chemnitz University of Technology, Germany; University Hospital Leipzig, Germany), Sebastian Knopp (Chemnitz University of Technology, Germany), Philipp Klimant (Chemnitz University of Technology, Germany), Johannes Quellmalz (Chemnitz University of Technology, Germany), and Holger Schlegel (Chemnitz University of Technology, Germany)

Designing a Multitasking Interface for Object-Aware AR Applications ..39
Brandon Huynh (University of California, Santa Barbara, USA), Jason Orlosky (Osaka University, Japan; Augusta University, USA), and Tobias Höllerer (University of California, Santa Barbara, USA)

Effects of Behavioral and Anthropomorphic Realism on Social Influence with Virtual Humans in AR ..41
Hanseul Jun (Stanford University, USA) and Jeremy Bailenson (Stanford University, USA)

Evaluation of Different Visualization Techniques for Perception- Based Alignment in Medical AR ..45
Marc J. Fischer (Stanford University, USA), Christoph Leuze (Stanford University, USA), Stephanie L. Perkins (Stanford University, USA), Jarrett Rosenberg (Stanford University, USA), Bruce Daniel (Stanford University, USA), and Alejandro Martin-Gomez (Technical University of Munich, Germany)

Exploring Virtual Environments by Visually Impaired Using a Mixed Reality Cane Without Visual Feedback ..51
Lei Zhang (City University of New York (BMCC), USA), Kelvin Wu (City University of New York (BMCC), USA), Bin Yang (City University of New York (BMCC), USA), Hao Tang (City University of New York (BMCC), USA), and Zhigang Zhu (The City College of New York, USA; The CUNY Graduate Center, New York, USA)

Extended by Design: A Toolkit for Creation of XR Experiences ..57
Arlindo Gomes (Centro de Informática/Voxar Labs, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Lucas Silva Figueiredo (Centro de Informática/Voxar Labs, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Walter F M Correia (Design, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Veronica Teichrieb (Voxar Labs, CIn/UFPE, Recife, Pernambuco, Brazil), Jonysberg Quintino (CIn/Samsung Project, UFPE, Recife, PE, Brazil), Fabio Q. B. Da Silva (Centro de Informática, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Andre L M Santos (Centro de Informática, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), and Helder De Sousa Pinho (Development, SiDi, Campinas, SP, Brazil)

Ginput: A Tool for Fast Hi-Fi Prototyping of Gestural Interactions in Virtual Reality .63
Jose Roberto Fonseca (Voxar Labs, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Jader Abreu (Voxar Labs, Universidade Federal de Pernambuco, Recife, PE, Brazil), Lucas Silva Figueiredo (Centro de Informática/Voxar Labs, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), José Gomes Neto (Voxar Labs, Universidade Federal de Pernambuco, Recife, PE, Brazil), Veronica Teichrieb (Voxar Labs, CIn/UFPE, Recife, Pernambuco, Brazil), Jonysberg P. Quintino (CIn/Samsung Project, UFPE, Recife, PE, Brazil), Fabio Q. B. Da Silva (Centro de Informática, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Andre L M Santos (Centro de Informática, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), and Helder De Sousa Pinho (Development, SiDi, Campinas, SP, Brazil)

HuTrain: a Framework for Fast Creation of Real Human Pose Datasets .65
Ricardo Rossiter Barioni (Voxar Labs, Federal University of Pernambuco (UFPE), Recife, Brazil), Willams De Lima Costa (Center for Informatics, Federal University of Pernambuco, Recife, Pernambuco, Brazil), José André Carneiro Neto (Voxar Labs, Federal University of Pernambuco (UFPE), Recife, Brazil), Lucas Silva Figueiredo (Centro de Informática/Voxar Labs, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Veronica Teichrieb (Voxar Labs, CIn/UFPE, Recife, Pernambuco, Brazil), Jonysberg P. Quintino (CIn/Samsung Project, UFPE, Recife, PE, Brazil), Fabio Q. B. Da Silva (Centro de Informática, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), Andre L M Santos (Centro de Informática, Universidade Federal de Pernambuco, Recife, Pernambuco, Brazil), and Helder De Sousa Pinho (Development, SiDi, Campinas, SP, Brazil)

Industrial Augmented Reality: Concepts and User Interface Designs for Augmented Reality Maintenance Worker Support Systems .67
Mario Lorenz (Chemnitz University of Technology, Germany; University Hospital Leipzig, Germany), Jisu Kim (Bauhaus-Universität Weimar, Germany; Chemnitz University of Technology, Germany), Sebastian Knopp (Chemnitz University of Technology, Germany), and Philipp Klimant (Chemnitz University of Technology, Germany)

Intention to use an Interactive AR app for Engineering Education .70
Alejandro Alvarez-Marin (Departamento de Ingeniería Industrial, Universidad de La Serena, Chile), J Ángel Velázquez-Iturbide (Universidad Rey Juan Carlos, Spain), and Mauricio Castillo-Vergara (Universidad Alberto Hurtado, Chile)

Locomotive and Cognitive Trade-Offs for Target-Based Travel .74
Chengyuan Lai (The University of Texas at Dallas, USA), Afham Aiyaz (The University of Texas at Dallas, USA), and Ryan P. Mcmahan (University of Central Florida, USA)

MiXR: A Hybrid AR Sheet Music Interface for Live Performance .76
Shalva A. Kohen (Columbia University, New York, USA), Carmine Elvezio (Columbia University, New York, USA), and Steven Feiner (Columbia University, New York, USA)

Modeling Emotions for Training in Immersive Simulations (METIS): A Cross-Platform Virtual Classroom Study .78
Alban Delamarre (Visage Lab - SCIS, Florida International University, USA), Christine Lisetti (Visage Lab - SCIS, Florida International University, USA), and Cédric Buche (ENIB, CERV, Lab-STICC, France)

Real-Time Gait Reconstruction for Virtual Reality Using a Single Sensor .84
Tobias Feigl (Fraunhofer Institute for Integrated Circuits (IIS), Nürnberg, Germany; Machine Learning and Information Fusion Group, Fraunhofer Institute for Integrated Circuits, Germany), Lisa Gruner (Hybrid Positioning and Information Fusion, Fraunhofer Institute for Integrated Circuits (IIS), Germany), Christopher Mutschler (Fraunhofer, Institute for Integrated Circuits IIS, Germany), and Daniel Roth (Technical University Munich, Computer Aided Medical Procedures and Augmented Reality, Germany)

Small Marker Tracking with Low-Cost, Unsynchronized, Movable Consumer Cameras For Augmented Reality Surgical Training .90
Nicholas Rewkowski (UNC Chapel Hill, USA; UMD College Park, College Park, USA), Andrei State (UNC Chapel Hill, USA), and Henry Fuchs (UNC, Chapel Hill, USA)

Stepping Over Obstacles with Augmented Reality Based on Visual Exproprioception .96
Alessandro Luchetti (University of Trento, Italy), Edoardo Parolin (University of Trento, Italy), Isidro Iii Butaslac (Nara Institute of Science and Technology, Japan), Yuichiro Fujimoto (Nara Institute of Science and Technology, Japan), Masayuki Kanbara (Science and Technology, Nara Institute of Science and Technology, Japan), Paolo Bosetti (University of Trento, Italy), Mariolino De Cecco (University of Trento, Italy), and Hirokazu Kato (Nara Institute of Science and Technology, Japan)

The Comfort Benefits of Gaze-Directed Steering .102
Chengyuan Lai (The University of Texas at Dallas, USA), Xinyu Hu (University of Central Florida, USA), Ann Segismundo (The Hockaday School, Dallas, Texas, USA), Ananya A. Phadke (The Hockaday School, Dallas, Texas, USA), and Ryan P. Mcmahan (University of Central Florida, USA)

User-Aided Global Registration Method using Geospatial 3D Data for Large-Scale Mobile Outdoor Augmented Reality .104
Simon Burkard (University of Applied Sciences HTW Berlin, Germany) and Frank Fuchs-Kittowski (University of Applied Sciences HTW Berlin, Germany)

Virtual Reality in Education: A Case Study on Exploring Immersive Learning for Prisoners .110
Jonny Collins (University of Otago, Dunedin, New Zealand), Tobias Langlotz (University of Otago, Dunedin, New Zealand), and Holger Regenbrecht (University of Otago, Dunedin, New Zealand)

"Kapow!": Augmenting Contacts with Real and Virtual Objects Using Stylized Visual Effects .116
Victor Rodrigo Mercado (Inria Rennes, Rennes, France), Jean-Marie Normand (AAU UMR CNRS 1563 & Inria Hybrid, Ecole Centrale de Nantes, Nantes, France), and Anatole Lécuyer (Inria, Rennes, France)

3D Human Model Creation on a Serverless Environment .118.....
Peter Fasogbon (Nokia Technologies, Tampere, Pirkanmaa, Finland; Nokia Technologies, Tampere, Pirkanmaa, Finland), Yu You (Nokia Technologies, Tampere, Pirkanmaa, Finland; Nokia Technologies, Tampere, Pirkanmaa, Finland), and Emre Aksu (Nokia Technologies, Tampere, Pirkanmaa, Finland; Nokia Technologies, Tampere, Pirkanmaa, Finland)

A Brain-Computer Interface and Augmented Reality Neurofeedback to Treat ADHD: A Virtual Telekinesis Approach .123.....
G S Rajshekar Reddy (Information Science and Engineering, Ramaiah Institute of Technology, Bangalore, India) and Lingaraju G M (Information Science and Engineering, Ramaiah Institute of Technology, Bangalore, India)

A Sense of Quality for Augmented Reality Assisted Process Guidance .129.....
Anes Redzepagic (Machine Learning and Data Analytics Lab, Friedrich-Alexander University Erlangen-Nürnberg, Germany), Christoffer Löffler (Machine Learning and Data Analytics Lab, Friedrich-Alexander University Erlangen-Nürnberg, Germany), Tobias Feigl (Programming Systems Group, Friedrich-Alexander University, Erlangen-Nürnberg, Germany), and Christopher Mutschler (Ludwig-Maximilians-University (LMU), Germany)

A User Study on AR-Assisted Industrial Assembly .135.....
Florian Schuster (University of Applied Sciences Würzburg-Schweinfurt, Germany), Uwe Sponholz (University of Applied Sciences Würzburg-Schweinfurt, Germany), Bastian Engelmann (University of Applied Sciences Würzburg-Schweinfurt, Germany), and Jan Schmitt (University of Applied Sciences Würzburg-Schweinfurt, Germany; Institute Digital Engineering, Germany)

A Virtual Morris Water Maze to Study Neurodegenarative Disorders .141.....
Daniel Roth (Technical University Munich, Computer Aided Medical Procedures and Augmented Reality, Germany), Christian Felix Purps (HCI Group, University of Würzburg, Germany), and Wolf-Julian Neumann (Charité Berlin, Germany)

An Exploratory Study for Designing Social Experience of Watching VR Movies Based on Audience's Voice Comments .147.....
Shuo Yan (School of New Media Art and Design, Beihang University, Beijing, China; State Key Laboratory of Virtual Reality Technology and Systems, Beihang University, Beijing, China), Wenli Jiang (School of New Media Art and Design, Beihang University, BeiJing, China), Menghan Xiong (School of New Media Art and Design, Beihang University, Beijing, China), and Xukun Shen (Key Laboratory of Virtual Reality Technology and System, Beihang University, Beijing, China; School of New Media Art and Design, Beihang University, Beijing, China)

AR-Chat: an AR-Based Instant Messaging System .153
Pierrick Jouet (Immersive Lab, InterDigital R&D, Cesson-Sévigné, France), Anthony Laurent (Immersive Lab, InterDigital R&D, Cesson-Sévigné, France), Tao Luo (Immersive Lab, InterDigital R&D, Cesson-Sévigné, France), Vincent Alleaume (Immersive Lab, Interdigital R&D, Cesson-Sévigné, France), Matthieu Fradet (Immersive Lab, InterDigital R&D, Cesson-Sévigné, France), and Caroline Baillard (Immersive Lab, InterDigital R&D, Cesson-Sévigné, France)

Augmented Illusionism. The Influence of Optical Illusions through Artworks with Augmented Reality .158
Borja Jaume Pérez (Universidad Complutense de Madrid, Madrid, Spain)

Comparing Single-Modal and Multimodal Interaction in an Augmented Reality System .165
Zhimin Wang (State Key Laboratory of VR Technology and Systems, School of Computer Science and Engineering, Beihang University, Beijing, China), Huangyue Yu (State Key Laboratory of VR Technology and Systems, School of Computer Science and Engineering, Beihang University, Beijing, China), Haofei Wang (Peng Cheng Laboratory, Shenzhen, China), Zongji Wang (State Key Laboratory of VR Technology and Systems, School of Computer Science and Engineering, Beihang University, Beijing, China), and Feng Lu (State Key Laboratory of VR Technology and Systems, School of Computer Science and Engineering, Beihang University, Beijing, China)

Decoupled Localization and Sensing with HMD-Based AR for Interactive Scene Acquisition .167
Soeren Skovsen (Aarhus University, Denmark), Harald Haraldsson (Cornell Tech, New York, USA), Abe Davis (Cornell University, New York, USA), Henrik Karstoft (Aarhus University, Denmark), and Serge Belongie (Cornell University, New York, USA)

Design Preferences on Industrial Augmented Reality: A Survey with Potential Technical Writers .172
Michele Gattullo (DMMM, Polytechnic University of Bari, Italy), Lucilla Dammacco (DMMM, Polytechnic University of Bari, Italy), Francesca Ruospo (DMMM, Polytechnic University of Bari, Italy), Alessandro Evangelista (DMMM, Polytechnic University of Bari, Italy), Michele Fiorentino (DMMM, Polytechnic University of Bari, Italy), Jan Schmitt (IDEE, University of Applied Sciences Würzburg-Schweinfurt, Germany), and Antonio E. Uva (DMMM, Polytechnic University of Bari, Italy)

Distortion Correction Algorithm of AR-HUD Virtual Image Based on Neural Network Model of Spatial Continuous Mapping .178
Ke Li (Chongqing University of Posts and Telecommunications, China), Ling Bai (Chongqing University of Posts and Telecommunications, China; Mcmaster University, Hamilton, Canada), Yinguo Li (Chongqing University of Posts and Telecommunications, China), and Zhongkui Zhou (Chongqing University of Posts and Telecommunications, China)

Effects of Augmented Content's Placement and Size on User's Search Experience in Extended Displays .184
Sunyoung Bang (KAIST, DAEJEON, Korea, Republic of), Hyunjin Lee (KAIST, DAEJEON, Korea, Republic of), and Woontack Woo (GSCT, KAIST, Daejeon, Korea, Republic of)

Effects of Background Complexity and Viewing Distance on an AR Visual Search Task .189
Hyunjin Lee (KAIST, DAEJEON, Korea, Republic of), Sunyoung Bang (Korea Advanced Institute of Science and Technology, Daejeon, Korea, Republic of), and Woontack Woo (GSCT, KAIST, Daejeon, Korea, Republic of)

EmnDash: M-Sequence Dashed Markers on Vector-Based Laser Projection for Robust High-Speed Spatial Tracking .195
Ryota Nishizono (The University of Tokyo, Japan), Tomohiro Sueishi (The University of Tokyo, Japan), and Masatoshi Ishikawa (The University of Tokyo, Japan)

Evaluate Optimal Redirected Walking Planning Using Reinforcement Learning .201
Tsai-Yen Ko (National Cheng Kung University, Tainan, Taiwan), Li-Wen Su (National Cheng Kung University, Tainan, Taiwan), Chang Yuchen (The University of Tokyo, Japan), Keigo Matsumoto (The University of Tokyo, Japan), Takuji Narumi (The University of Tokyo, Japan), and Michitaka Hirose (The University of Tokyo, Japan)

Industrial Augmented Reality: 3D-Content Editor for Augmented Reality Maintenance Worker Support System .203
Mario Lorenz (Chemnitz University of Technology, Germany; University Hospital Leipzig, Germany), Sebastian Knopp (Chemnitz University of Technology, Germany), Jisu Kim (Chemnitz University of Technology, Germany; Architecture and Urbanism, Bauhaus-Universität Weimar, Germany), and Philipp Klimant (Chemnitz University of Technology, Germany)

Investigating Three-Dimensional Directional Guidance with Nonvisual Feedback for Target Pointing Task .206
Seunga Chung (Ewha Womans University, Seoul, Korea, Republic of), Kyungyeon Lee (Ewha Womans University, Seoul, Korea, Republic of), and Uran Oh (Ewha Womans University, Seoul, Korea, Republic of)

LCR-SMPL: Toward Real-Time Human Detection and 3D Reconstruction from a Single RGB Image .211
Elena Peña-Tapia (Keio University, Yokohama, Japan; Cross Compass Ltd., Tokyo, Japan), Ryo Hachiuma (Keio University, Yokohama, Japan), Antoine Pasquali (Cross Compass Ltd., Tokyo, Japan), and Hideo Saito (Keio University, Yokohama, Japan)

Living with Rules: An AR Approach .213
Vinu Kamalasanan (Institute of Carthography and Geoinformatics, Liebniz University, Hannover, Germany) and Monika Sester (Institute of Carthography and Geoinformatics, Leibniz University, Hannover, Germany)

Lower Limb Balance Rehabilitation of Post-Stroke Patients Using an Evaluating and Training Combined Augmented Reality System ..217
Shuwei Chen (State Key Laboratory of Virtual Reality Technology and Systems, Beihang University, Beijing, China), Ben Hu (State Key Laboratory of Virtual Reality Technology and Systems, Beihang University, Beijing, China;Ningbo University, Ningbo, China), Yang Gao (State Key Laboratory of Virtual Reality Technology and Systems, Beihang University, Beijing, China; Research Institute of Frontier Science, Beihang University, Beijing, China), Zhiping Liao (Sir Run Run Shaw Hospital, Zhejiang University School of Medicine, Hangzhou, China), Jianhua Li (Sir Run Run Shaw Hospital, Zhejiang University School of Medicine, Hangzhou, China), and Aimin Hao (State Key Laboratory of Virtual Reality Technology and Systems, Beihang University, Beijing, China; Research Institute of Frontier Science, Beihang University, Beijing, China)

LSFB: A Low-Cost and Scalable Framework for Building Large-Scale Localization Benchmark ..219
Haomin Liu (Sensetime, Hangzhou, Zhejiang, China), Mingxuan Jiang (SenseTime, Hangzhou, Zhejiang, China), Zhuang Zhang (SenseTime, Hangzhou, Zhejiang, China), Xiaopeng Huang (SenseTime, Hangzhou, Zhejiang, China), Linsheng Zhao (Sensetime, Hangzhou, Zhejiang, China), Meng Hang (Sensetime, Beijing, China), Youji Feng (SenseTime, Hang Zhou, Zhejiang, China), Hujun Bao (State Key Lab of CAD&CG, Zhejiang University, Computer Science College, Hangzhou, Zhejiang, China), and Guofeng Zhang (State Key Lab of CAD&CG, Zhejiang University, Computer Science College, Hangzhou, Zhejiang, China)

Machine Intelligence Matters: Rethink Human-Robot Collaboration Based on Symmetrical Reality ..225
Zhenliang Zhang (Tencent, Shenzhen, China) and Xuejiao Wang (National Engineering Laboratory for Public Safety Risk Perception and Control by Big Data (NEL-PSRPC), China Academy of Electronics and Information Technology, Beijing, China)

Multi-feature 3D Object Tracking with Adaptively-Weighted Local Bundles ..229
Jiachen Li (Shandong University, Jinan, China), Fan Zhong (Shandong University, Qingdao, China), and Xueying Qin (Shandong University, Jinan, China)

Perceptions of Integrating Augmented Reality Into Network Cabling Tutors ..231
Bradley Herbert (Research Centre for Interactive and Virtual Environments, University of South Australia, Mawson Lakes, Adelaide, South Australia, Australia), Grant Wigley (University of South Australia STEM, University of South Australia, Mawson Lakes, Adelaide, South Australia, Australia), Barrett Ens (Research Centre for Interactive and Virtual Environments, University of South Australia, Mawson Lakes, Adelaide, South Australia, Australia; Monash University, Melbourne, Australia), and Mark Billinghurst (Research Centre for Interactive and Virtual Environments, University of South Australia, Mawson Lakes, Adelaide, South Australia, Australia)

Pleistocene Crete: A Narrative, Interactive Mixed Reality Exhibition that Brings Prehistoric Wildlife Back to Life ..237
Konstantinos Cornelis Apostolakis (Institute of Computer Science (ICS), Foundation for Research and Technology – Hellas (FORTH), Heraklion, Crete, Greece), George Margetis (Institute of Computer Science (ICS), Foundation for Research and Technology – Hellas (FORTH), Heraklion, Crete, Greece), and Constantine Stephanidis (Institute of Computer Science, Foundation for Research and Technology - Hellas, Heraklion, Crete, Greece; Department of Computer Science, University of Crete, Heraklion, Crete, Greece)

PRISME: An Interaction Model Linking Domain Activities and Mixed and Tangible Interactors in Virtual Environments ..241
Jean-Michel Fazzari (UMR 6285/ENIB/Lab-STICC, IRT b<>com, Plouzané, France), Sébastien Kubicki (Lab-STICC, ENIB, Plouzanet, France), and Ronan Querrec (Lab-STICC, ENIB, Brest, France)

Real-Time Detection of Simulator Sickness in Virtual Reality Games Based on Players' Psychophysiological Data During Gameplay ..247
Jialin Wang (Xi'an Jiaotong-Liverpool University, Suzhou, Jiangsu, China), Hai-Ning Liang (Xi'an Jiaotong-Liverpool University, Suzhou, Jiangsu, China), Diego Vilela Monteiro (Xi'an Jiaotong-Liverpool University, Suzhou, Jiangsu, China), Wenge Xu (Xi'an Jiaotong-Liverpool University, Suzhou, Jiangsu, China), Hao Chen (Xi'an Jiaotong-Liverpool University, Suzhou, Jiangsu, China), and Qiwen Chen (Xi'an Jiaotong-Liverpool University, Suzhou, China)

Retargetable AR: Context-Aware Augmented Reality in Indoor Scenes Based on 3D Scene Graph .. 249
Tomu Tahara (R&D Center, Sony Corporation, Tokyo, Japan), Takashi Seno (R&D Center, Sony Corporation, Tokyo, Japan), Gaku Narita (R&D Center, Sony Corporation, Tokyo, Japan), and Tomoya Ishikawa (R&D Center, Sony Corporation, Tokyo, Japan)

Stencil Marker: Designing Partially Transparent Markers for Stacking Augmented Reality Objects ..255
Xuan Zhang (Tokyo Institute of Technology, Japan), Jonathan Lundgren (Linköping University, Sweden), Yoya Mesaki (Nishizaki Laboratory, Tokyo Institution of Technology, Japan), Yuichi Hiroi (Augmented Vision Lab, Tokyo Institute of Technology, Yokohama, Japan), and Yuta Itoh (Tokyo Institute of Technology, Yokohama, Japan; AIP, RIKEN, Tokyo, Japan)

TGA: Two-Level Group Attention for Assembly State Detection ..258
Hangfan Liu (TU Kaiserslautern, Germany), Yongzhi Su (TU Kaiserslautern, Germany), Jason Rambach (German Research Center for Artificial Intelligence (DFKI), Kaiserslautern, Germany), Alain Pagani (German Research Center for Artificial Intelligence, Kaiserslautern, Germany), and Didier Stricker (German Research Center for Artificial Intelligence, Kaiserslautern, Germany; TU Kaiserslautern, Germany)

Towards an AR Game for Walking Rehabilitation: Preliminary Study of the Impact of Augmented Feedback Modalities on Walking Speed 264
Anne-Laure Guinet (IBISC, Univ Evry, Université Paris-Saclay, Evry, France; Pôle Recherche&Innovation, Fondation Ellen Poidatz, Saint Fargeau Ponthierry, France), Guillaume Bouyer (IBISC, Univ Evry, Université Paris-Saclay, Evry, France), Samir Otmane (IBISC, Univ Evry, Univ Paris-Saclay, Evry, France), and Eric Desailly (Pôle Recherche&Innovation, Fondation Ellen Poidatz, Saint Fargeau Ponthierry, France)

Towards Sailing Supported by Augmented Reality: Motivation, Methodology and Perspectives 269
Francesco Laera (DMMM, Polytechnic University of Bari, Italy), Antonio Boccaccio (DMMM, Polytechnic University of Bari, Italy), Joseph L Gabbard (Virginia Tech, Blacksburg, Virginia, USA), Mario Massimo Foglia (DMMM, Polytechnic University of Bari, Italy), Michele Gattullo (DMMM, Polytechnic University of Bari, Italy), Antonio E. Uva (DMMM, Polytechnic University of Bari, Italy), Alessandro Evangelista (DMMM, Polytechnic University of Bari, Italy), Vito M Manghisi (DMMM, Polytechnic University of Bari, Italy), and Michele Fiorentino (DMMM, Polytechnic University of Bari, Italy)

Understanding Physical Common Sense in Symmetrical Reality 275
Zhenliang Zhang (Tencent, Shenzhen, China)

Usability Considerations of Hand Held Augmented Reality Wiring Tutors 277
Bradley Herbert (Research Centre for Interactive and Virtual Environments, University of South Australia, Australia), William Hoff (Research Centre for Interactive and Virtual Environments, University of South Australia, South Australia, Australia; Colorado School of Mines, USA), and Mark Billinghurst (Research Centre for Interactive and Virtual Environments, University of South Australia, Australia)

User Study on Virtual Reality for Design Reviews in Architecture 283
Michele Fiorentino (DMMM, Polythecnic Institute of Bari, Italy), Alessandro De Bellis (Dicar, Politecnico di Bari, Italy), Oliver Straeter (University of Kassel, Germany), Elisa Maria (University of Kassel, Germany), Ilaria Cavaliere (Dicar, Politecnico di Bari, Italy), Gabriele Sorrento (Mindesk, San Francisco, USA), Alemanno Maria Lucia Valentina (Dicar, Politecnico di Bari, Italy), Dario Costantino (Dicar, Politecnico di Bari, Italy), Isabella Giordano (Dicar, Politecnico di Bari, Italy), and Giuseppe Fallacara (Dicar, Politecnico di Bari, Italy)

Using Space Syntax to Enable Walkable AR Experiences 289
Derek Reilly (Dalhousie University, Nova Scotia, Canada), Joseph Malloch (Dalhousie University, Nova Scotia, Canada), Abbey Singh (Dalhousie University, Nova Scotia, Canada), Isaac Fresia (Dalhousie University, Nova Scotia, Canada), Shivam Mahajan (Dalhousie University, Nova Scotia, Canada), Jake Moore (Dalhousie University, Nova Scotia, Canada), and Matthew Peachey (Dalhousie University, Nova Scotia, Canada)

Doctoral Consortium Papers

Using Augmented Reality to Explore Museum Artifacts 295
Rayed A. Alakhtar (University of Technology Sydney, Australia)

Developing an eXtended Reality platform for Immersive and Interactive Experiences for Cultural Heritage: Serralves Museum and Coa Archeologic Park 300
Manuel Silva (Universidade Católica Portuguesa, Portugal) and Luis Teixeira (Universidade Católica Portuguesa, Portugal)

Intelligent Adaptive Agents and Trust in Virtual and Augmented Reality 303
Ningyuan Sun (University of Luxembourg) and Jean Botev (University of Luxembourg)

Augmented Reality Narratives for Post-Traumatic Stress Disorder Treatment 306
Liu Chang (City University of Hong Kong), Alvaro Cassinelli (City University of Hong Kong), and Christian Sandor (City University of Hong Kong)

Evaluation of Stroke Assessment in Simulated Virtual World 310
Mattia S. Mancosu (Liverpool John Moores University)

Augmented Reality for Easy Sailing 312
Francesco Laera (Polytechnic University of Bari, Department of Mechanics, Mathematics and Management)

Exploring Design Strategies for Augmented Reality Learning Experience in Classrooms 314
Pratiti Sarkar (Indian Institute of Technology Bombay, India)

Workshop Papers

Augmented Reality for Vocational Education Training in K12 Classrooms 317
Manshul Belani (Indraprastha Institute of Information Technology Delhi, India) and Aman Parnami (Indraprastha Institute of Information Technology Delhi, India)

Remote Assistance System in Augmented Reality for Early School Dropout Prevention 321
Marina A. Cidota (University of Bucharest, Romania) and Dragoş Datcu (PrimeVision B.V., Delft, The Netherlands)

Arsinoe-Learning Egyptian Hieroglyphs with Augmented Reality and Machine Learning 326
David A. Plecher (Technical University of Munich, Germany), Christian Eichhorn (Technical University of Munich, Germany), Khaled M. Seyam (German University in Cairo), and Gudrun Klinker (Technical University of Munich, Germany)

Merging Geospatial Technologies with Cross Reality in the Context of Smart Manufacturing Systems 333
Raffaele de Amicis (Oregon State University, USA), William Z. Bernstein (National Institute of Standards and Technology, USA), Johannes Scholz (Graz University of Technology, Austria), Rafael Radkowski (Iowa State University, USA), Bruno Simões (Vicomtech), Joshua Lieberman (Open Geospatial Consortium), and Eric Prather (Oregon State University, USA)

Author Index 339 . . . . . .